

---

# **MANAGEMENT BRIEFING**

## **METHOD OF DESIGN FOR GROUND COOLANT SYSTEM TO MLP-1, -2, AND -3; OPF HB'S 1 AND 2; SLF; SLS; AND WSSH**

DECEMBER 1990

 **Lockheed**  
*Space Operations Company*

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## BACKGROUND - S70-0508 REPLACEMENT DESIGN

- LATE 1985 - DESIGN TO INVESTIGATE S70-0508 PROBLEMS AND FINAL LONG-RANGE SOLUTIONS PER DIRECTION FROM C. MARS
- EARLY 1986 - S70-0508 DESIGN RESPONSIBILITY TURNED OVER TO LSOC FROM RI
- MID 1986 TO 1987 - LSOC DE AND OPS FIELD TESTED S70-0508'S AND SUMMARIZED FINDINGS IN STUDY KSCL-3201-0060 RECOMMENDING INTERIM S70-0508 FIXES AND DEVELOPMENT OF A NEW GROUND COOLANT SYSTEM
- JUNE 1987 - CCBP ISSUED TO CREATE 30% DESIGN FOR REPLACEMENT OF S70-0508'S ON PAD AND TO CREATE S70-0508 MOD DRAWINGS
- JUNE 1987 TO MARCH 1988 - BIWEEKLY TEAM MEETINGS WITH NASA DE, OPS, SAFETY, AND LSOC DE, OPS, AND SAFETY HELD TO CREATE NEW CONCEPT
- DECEMBER 1987 - LSOC DE RELEASED S70-0508 MOD DRAWING 80K50536
- JANUARY 1988 - S70-0508 MODS PLACED ON HOLD DUE TO LACK OF FUNDING
- MARCH 1988 - IN-HOUSE NEW DESIGN AT 30% TO 45% LEVEL PLACED ON HOLD DUE TO LACK OF FUNDING

DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## BACKGROUND - S70-0508 REPLACEMENT DESIGN (CONT.)

- JUNE 1989 - REQUEST TO LSOC ACTIVATION TO UTILIZE NEW DESIGN AS A PROTOTYPE AT OPF HB-3
- AUGUST TO SEPTEMBER 1989 - TWO S70-0508'S MODIFIED; REMAINDER PUT ON HOLD DUE TO LACK OF FUNDING
- OCTOBER 1989 - IMPLEMENTATION OF NEW DESIGN FOR OPF HB-3 APPROVED BY KSC
- DECEMBER 1989 - MEETING REPRESENTING LONG-RANGE S70-0508 REPLACEMENT PRESENTED TO LEVEL I (REFERENCE CR NO. S50483D)
- JUNE 1990 - TCTI PREPARED TO MODIFY TWO ADDITIONAL S70-0508'S (PLACED ON HOLD DUE TO LACK OF FUNDING)
- JULY 1990 - NEW OPF HB-3 DESIGN COMPLETE
- OCTOBER 1990 - FPC ESTABLISHED FOR NEW SYSTEM
- NOVEMBER 1990 - NEW SYSTEM WELL UNDER CONSTRUCTION
- DECEMBER 1990 - REVISE JUNE 1990 TCTI TO ACCOMPLISH MODIFICATION OF THREE S70-0508'S
- MAY 1991 - NEW SYSTEM TO POWER UP AT KSC
- SEPTEMBER 1991 - NEW SYSTEM TO MEET OPF HB-3 ORD

DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## GROUND COOLANT UNIT ALLOCATION

<u>USE LOCATION</u>	<u>ACTUAL NO.</u>	<u>COMMENTS</u>
PAD A	2	RECENTLY REFURBISHED UNITS
PAD B	2-1/2	
OPF-1	1/2	
OPF-2	1	
SLF	1	
DFRF	2	UNITS DO NOT HAVE LPS CAPABILITY USED FOR MAINTENANCE
WSSH	1	
PALMDALE	2	
VAB-MBMR	1	
OPF-3	0	
TOTAL	13	

DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## GCU SUPPORT RECORD DURING HIGH LAUNCH PERIOD

- THREE TO FOUR UNITS CONSTANTLY UNDER REPAIR
- GCU'S WERE CONSTANTLY BEING MOVED BETWEEN SITES TO SUPPORT ORBITER TESTING
- THERE WERE TIMES WHEN ALL IN-COMMISSION UNITS WERE SUPPORTING TESTS WITH INSUFFICIENT BACK-UPS/COMPONENTS SPARES TO IMPROVE IN-COMMISSION RATE
- BACK-UP REQUIREMENTS DEVELOPED AS A MATTER OF LOW RELIABILITY -NOT OMRSD REQUIREMENTS

NOTE:

IT WAS NOT UNCOMMON TO WAIT 6 MONTHS FOR HIGH USAGE COMPONENTS (LIGHTS, SIGNAL CONDITIONERS, VALVES, QD'S, ETC.)

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## SUMMARY OF KSCL-3201-0060, S70-0508 RELIABILITY IMPROVEMENT AND 80K50611, MOD DRAWING

- REFRIGERATION MODULE
  - PROVIDE PERMANENT INSTRUMENTATION FOR ADJUSTMENT AND TROUBLE SHOOTING
  - REPLACE THE BELT-DRIVEN CONDENSER COIL FAN WITH A TWO-SPEED, DIRECT DRIVE, HEAD-PRESSURE-CONTROLLED FAN
  - PROVIDE A SUCTION ACCUMULATOR TO PREVENT LIQUID R-22 FROM RETURNING TO THE COMPRESSOR
  - REPLACE THE REFRIGERANT RECEIVER WITH A RECEIVER EQUIPPED WITH A SIGHT GLASS
  - REPLACE THE LIQUID LINE SIGHT GLASS WITH A SEE-THRU-TYPE SIGHT GLASS
- CIRCULATION MODULE
  - REMOVE THE EXISTING STORAGE CABINET FOR BETTER COMPONENT ACCESS
  - PROVIDE WEATHER-SEALED BLAST COVERS FOR THE INSTRUMENT PANELS

### NOTE:

ALL WORN COMPONENTS ARE TO BE REFURBISHED DURING FPC

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## MODIFIED S70-0508 SUMMARY

- THE TWO MODIFIED S70-0508'S HAVE PROVEN TO BE MUCH MORE PREDICTABLE AND RELIABLE, AND SUCCESSFULLY SUPPORTED (WITHOUT INCIDENT) ALL THREE LAUNCHES IN WHICH THEY WERE USED \*
  - THE BASIC S70-0508 DESIGN (HEAT LOAD CAPACITY) IS STILL OVER REQUIREMENTS AND CANNOT HANDLE THE WIDE RANGE OF HEAT LOADS REQUIRED FOR LAUNCH
  - THE LONG-TERM RELIABILITY OF THE MODIFIED S70-0508 UNITS IS LOW
  - MODIFICATION OF MORE S70-0508'S PENDING FUNDING
- \* THERE IS AN R-22 RECEIVER CERTIFICATION PROBLEM WHICH HAS BEEN WAIVED FOR STS-35. REPLACEMENT RECEIVERS ARE ON ORDER

DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## GROUND COOLANT UNITS FOR ORBITER PROCESSING

- PLAN
  - PHASE OUT S70-0508 UNITS AND REPLACE WITH FIXED GROUND COOLING SYSTEMS
- PRESENT
  - INSTALL NEW GROUND COOLING UNITS (S70-0509/0510/1203) AT OPF HB-3 TO IMPLEMENT THE DESIGN AND FUNCTIONALLY VERIFY THE SYSTEM
- REQUESTED
  - ADD THE SAME EQUIPMENT TO THE MLP'S WHICH WILL ELIMINATE CURRENT EQUIPMENT FOR VAB/PAD LOCATIONS AND IMPROVE RELIABILITY
  - ADD THE SAME EQUIPMENT TO OPF-1 AND OPF-2 FACILITIES
  - ADD SIMILAR EQUIPMENT TO THE LANDING SITES UTILIZING TRANSPORTERS
  - INTERIM FIX MODIFY ADDITIONAL S70-0508'S FOR BETTER MAINTAINABILITY AND ORBITER SUPPORT AT PADS/OPF

DECEMBER 1990



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

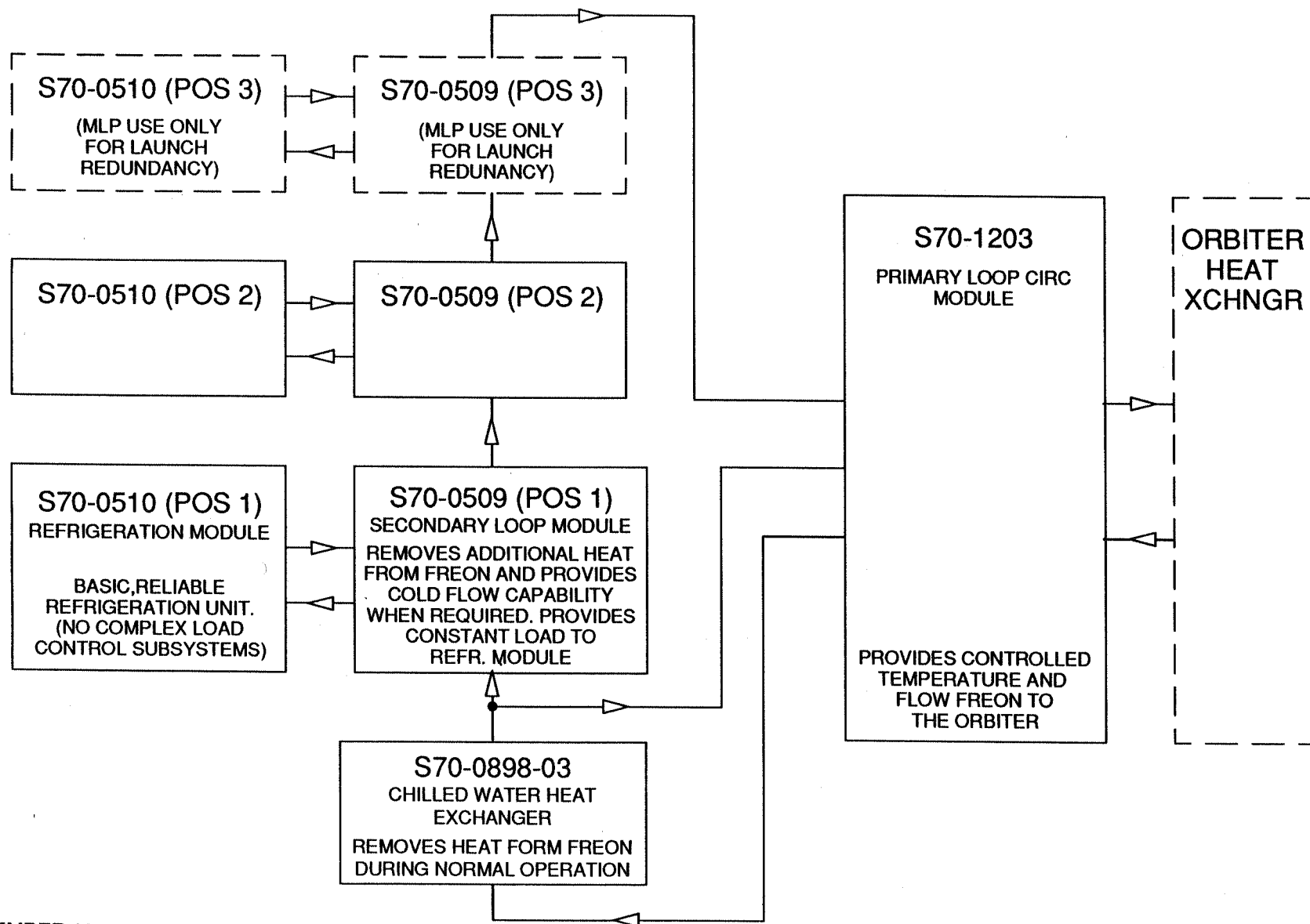
## NEW GROUND COOLANT SYSTEM FEATURES

- THE NEW GROUND COOLANT SYSTEM HAS MANY ENHANCEMENTS OVER THE S70-0508'S. IT WILL BE SIMPLER TO MAINTAIN AND OPERATE AND USES A STATE-OF-THE-ART CONTROL SYSTEM
- A SUMMARY OF THESE FEATURES IS ATTACHED FOR REFERENCE

DECEMBER 1990

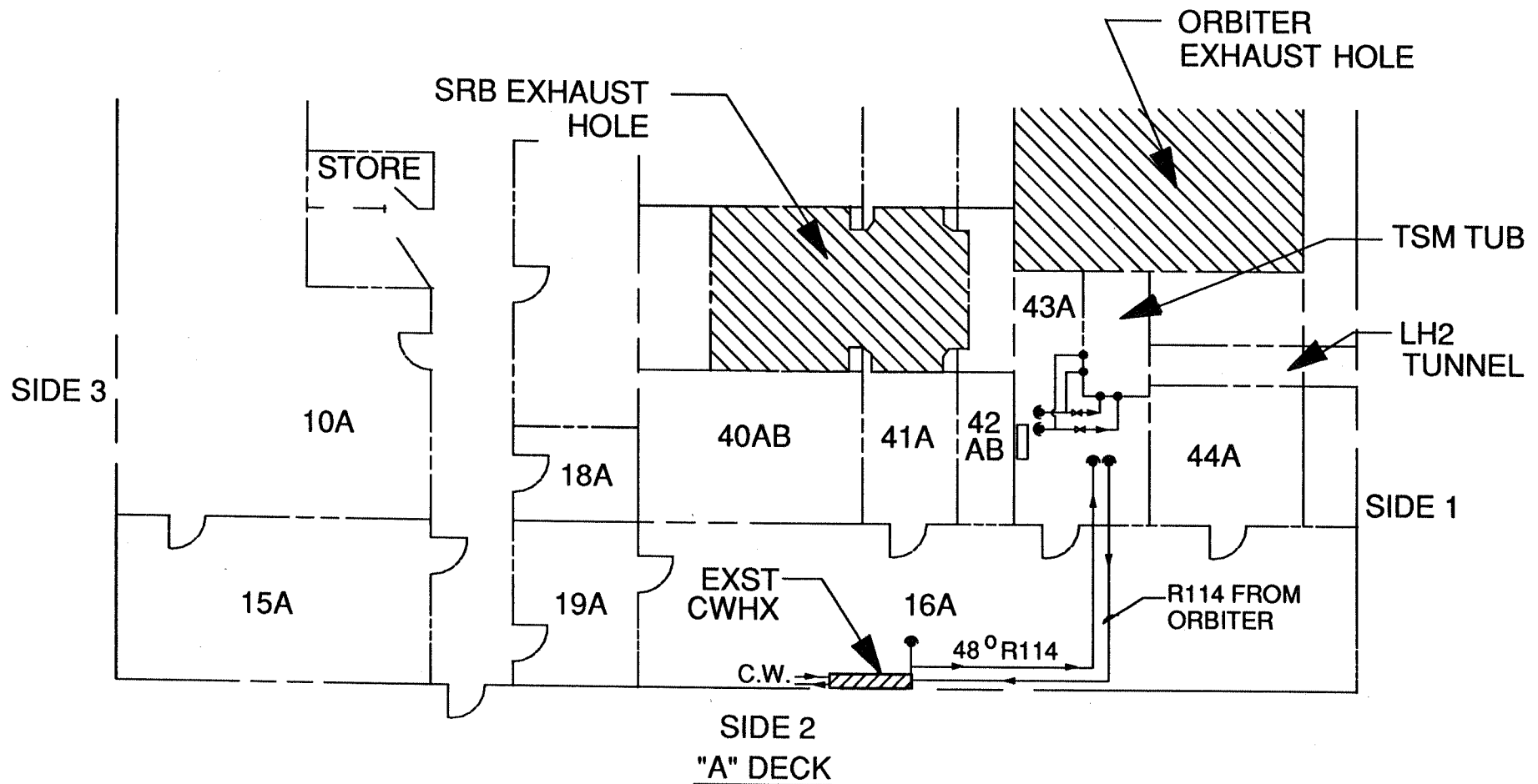
# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## BASIC SYSTEM DESCRIPTION



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

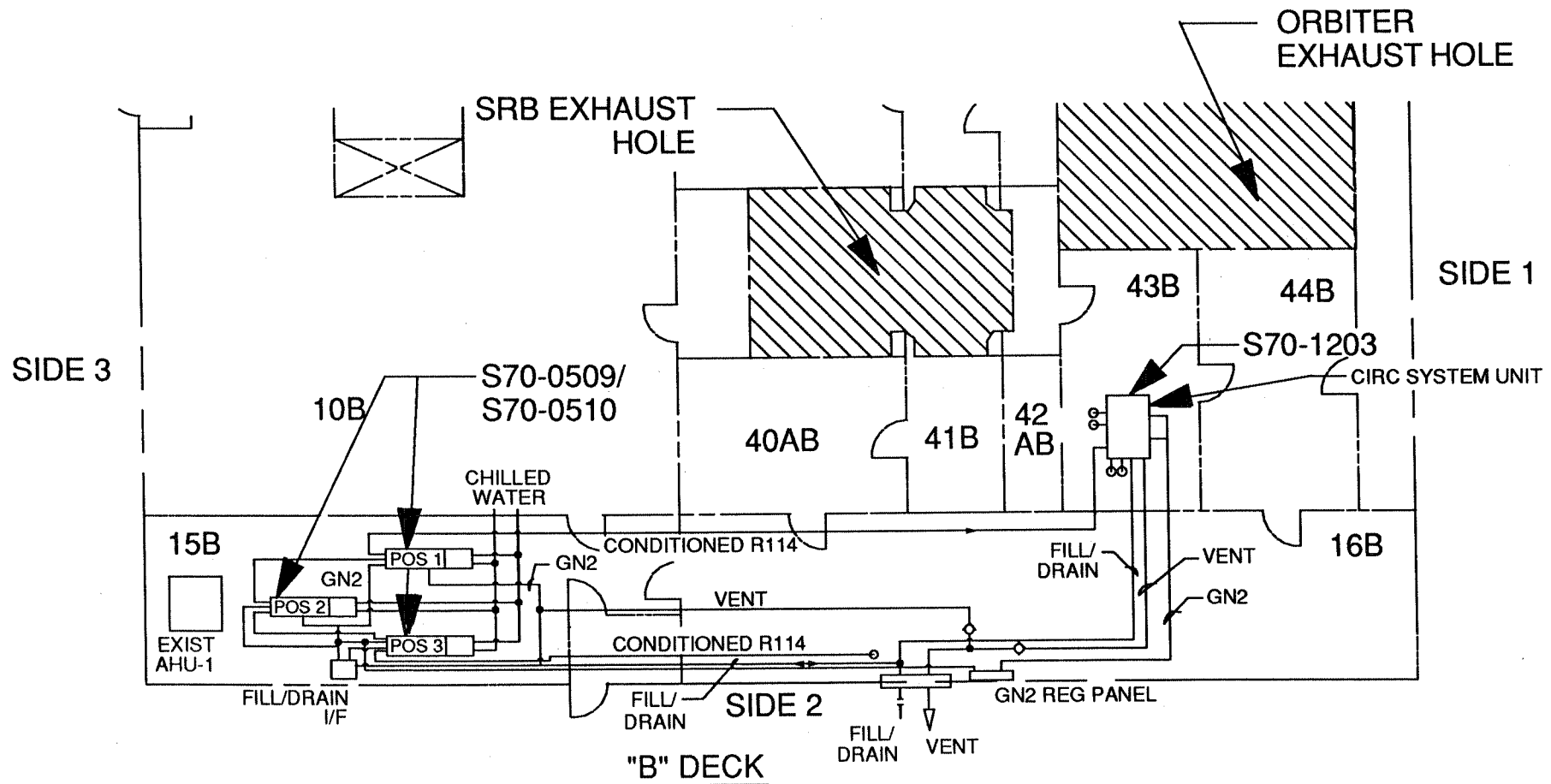
## MLP GROUND COOLANT SYSTEM FLOOR PLAN



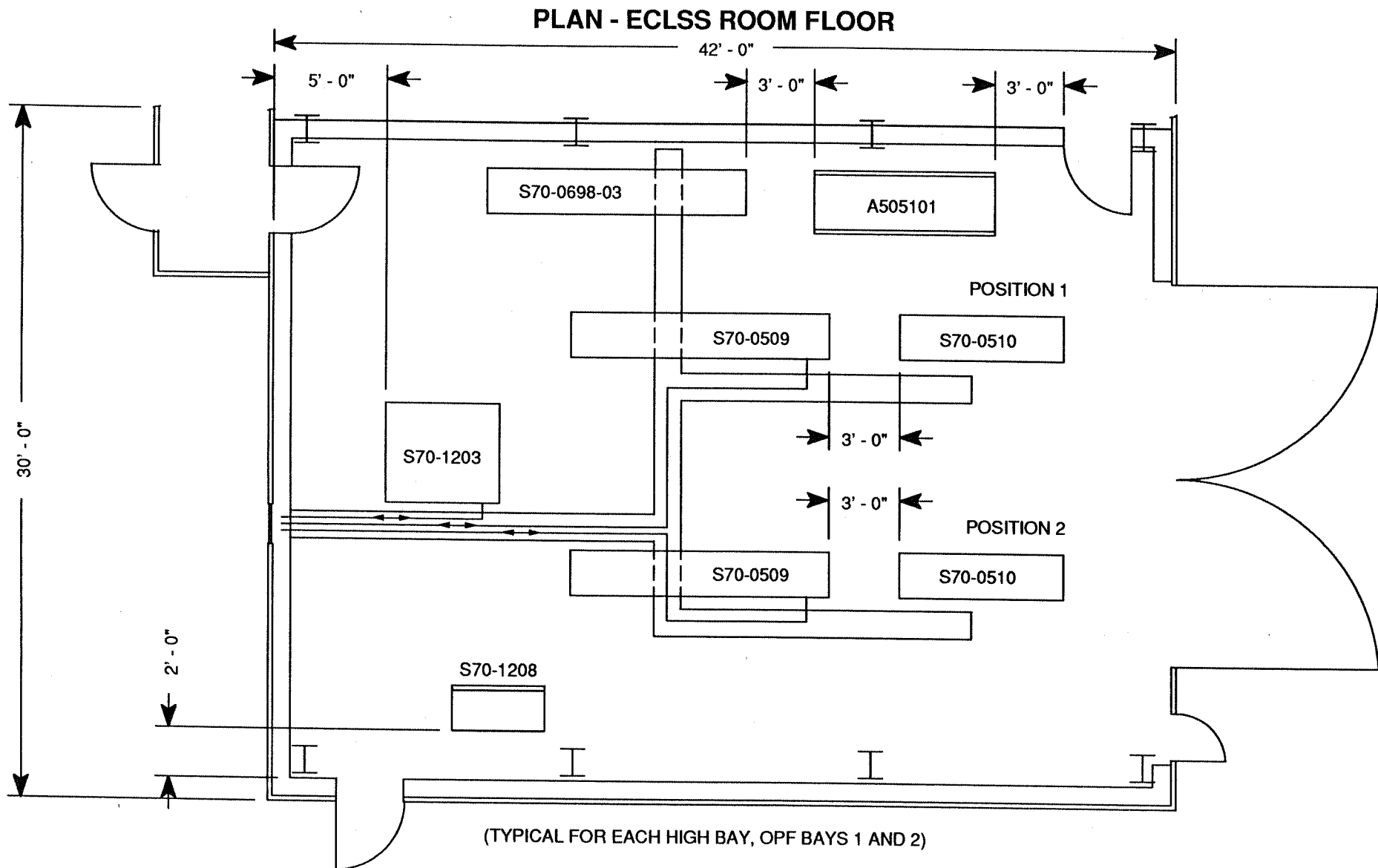
DECEMBER 1990  
GND\_COOL/FL\_PLAN2A

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## MLP GROUND COOLANT SYSTEM FLOOR PLAN



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM



DECEMBER 1990  
GND\_COOL/ECLSS\_PLAN

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## MLP-1, -2, AND -3 TASKS

- EQUIPMENT
  - DESIGN EXISTS
  - REQUIRES TCTI TO START FABRICATION
- MECHANICAL INSTALLATION DESIGN
  - MODIFY MLP COMPARTMENTS TO ACCOMMODATE GSE INSTALLATION
    - REMOVE FALSE FLOOR IN COMPARTMENT 15B
    - ADD ISOLATION MOUNTS
  - MODIFY FLUID DISTRIBUTION SYSTEM
- ELECTRICAL INSTALLATION DESIGN
  - PROVIDE NEW HIM'S
  - PROVIDE HARDWIRE SAFING PANEL IN FIRING ROOMS
  - ADD NEW CABLING TO GSE
  - PROVIDE COMPARTMENT 15B CONTROL STATION

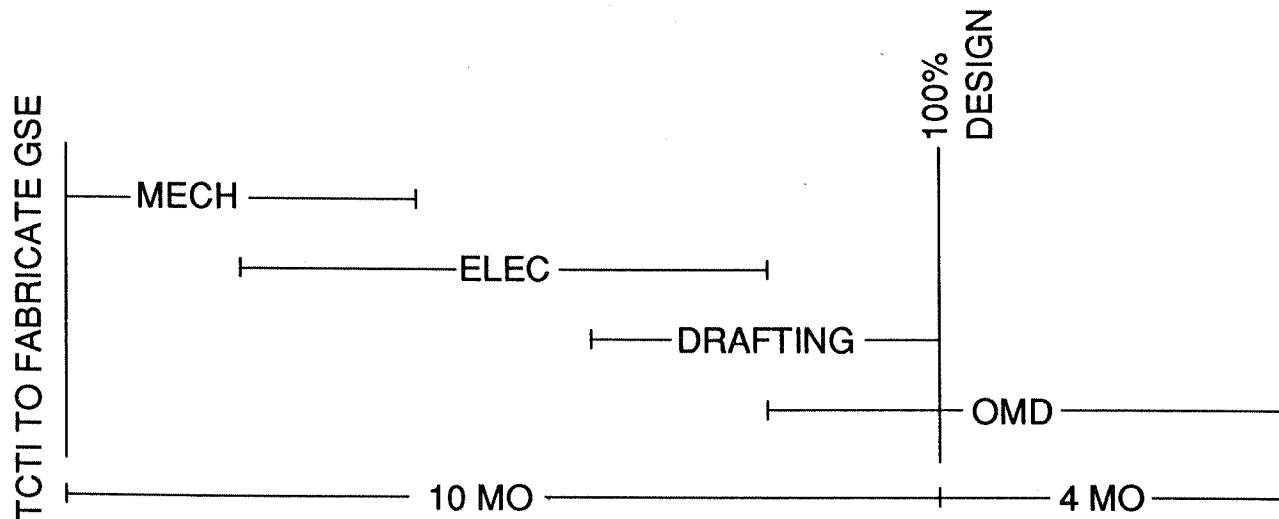
DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## MLP-1, -2, AND -3

### DESIGN

MECHANICAL	4 MO	640 MH
ELECTRICAL	6 MO	1,000 MH
DRAFTING	4 MO	640 MH
OMD	6 MO	500 MH



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## MLP-1, -2, AND -3

### COSTS

DESIGN	2,780 MH x \$33/MH	= \$ 91,740
EQUIPMENT	\$1.1 MILLION/MLP	= \$3,300,000
FPC-INSTL	\$350,000/MLP	= \$1,050,000
CHECKOUT	480 MH/MLP x \$33/MH	= \$ 47,520
SPARE LRU (509/510's)	\$400,000	= \$ 400,000
HIMS & OTHER	\$500,000/MLP (IF NEEDED)	= <u>\$1,500,000</u> *
TOTAL		= \$6,389,260

\* MAYBE REDUCED TO \$360,000 IF CURRENTLY AVAILABLE  
RUGGEDIZED VAFB HIMS ARE USED.

### INSTALLATION

1-1/2 YEARS AFTER COMPLETION OF DESIGN  
BASED ON WORKING ALL THREE MLP'S IN A  
PARALLEL EFFORT. GSE TO START FABRICATION  
AT START OF INSTALLATION DESIGN.

THESE ROM COST ESTIMATES ARE PROVIDED FOR PLANNING/INFORMATION  
PURPOSES ONLY, AND DO NOT CONSTITUTE COST AND PRICING DATA AND ARE  
NOT INTENDED TO BE A BASIS FOR NEGOTIATING BETWEEN LSOC AND NASA. IT IS  
NOT AN OFFER TO PERFORM THE SUBJECT WORK, BUT REPRESENTS AN ESTIMATE  
BASED ON OUR CURRENT UNDERSTANDING OF THE TASK.



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## OPF HB-1 AND HB-2 TASKS

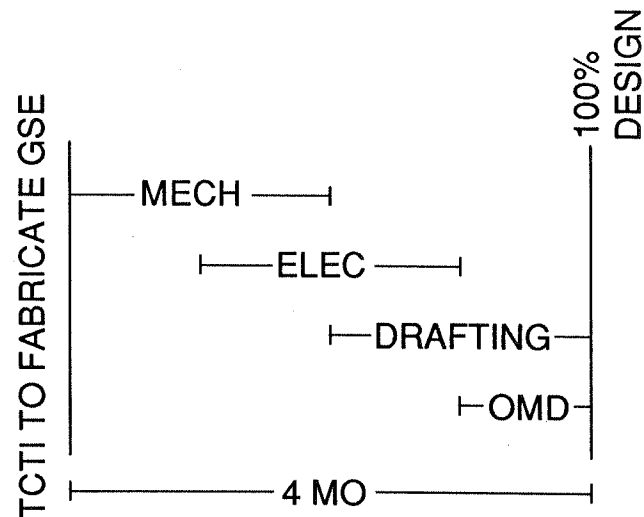
- EQUIPMENT
  - DESIGN EXISTS
  - REQUIRES TCTI TO START FABRICATION
- MECHANICAL INSTALLATION SYSTEM
  - MODIFY EXISTING FLUID DISTRIBUTION SYSTEM
- ELECTRICAL INSTALLATION SYSTEM
  - PROVIDE PATCHING AND CABLE INSTALLATION
- BUILDING
  - DESIGNED AND CONSTRUCTED USING C of F FUNDING

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## OPF HB-1 AND HB-2

### DESIGN

MECHANICAL	2 MO	320 MH
ELECTRICAL	2 MO	320 MH
DRAFTING	2 MO	320 MH
OMD	1 MO	100 MH



(EXCLUDES BUILDING DESIGN AND CONSTRUCTION)

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## OPF HB-1 AND HB-2

### EQUIPMENT COSTS

DESIGN	1,060 MH x \$33/MH	= \$ 34,980
EQUIPMENT	\$900,000/HB	= \$1,800,000
FPC-INSTL	\$200,000/HB	= \$ 400,000
CHECKOUT	480 MH/HB x \$33/MH	= \$ 31,680
TOTAL		= \$2,266,660

### INSTALLATION

9 MONTHS AFTER BUILDINGS ARE COMPLETE

THESE ROM COST ESTIMATES ARE PROVIDED FOR PLANNING/INFORMATION PURPOSES ONLY, AND DO NOT CONSTITUTE COST AND PRICING DATA AND ARE NOT INTENDED TO BE A BASIS FOR NEGOTIATING BETWEEN LSOC AND NASA. IT IS NOT AN OFFER TO PERFORM THE SUBJECT WORK, BUT REPRESENTS AN ESTIMATE BASED ON OUR CURRENT UNDERSTANDING OF THE TASK.

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## LANDING SITES TASKS

- EQUIPMENT
  - EXISTING DESIGN FOR INDOOR USE MUST BE MODIFIED
- MECHANICAL
  - ENCLOSE UNITS
  - PROVIDE AIR-COOLED CONDENSER
  - MODIFY TRAILER INSTALLATION
  - MODIFY FLUID DISTRIBUTION SYSTEM
- ELECTRICAL
  - PROVIDE NEW GENERATOR (TBD)
  - PROVIDE CABLES
  - PROVIDE MODIFIED CONTROL SYSTEM

### NOTE:

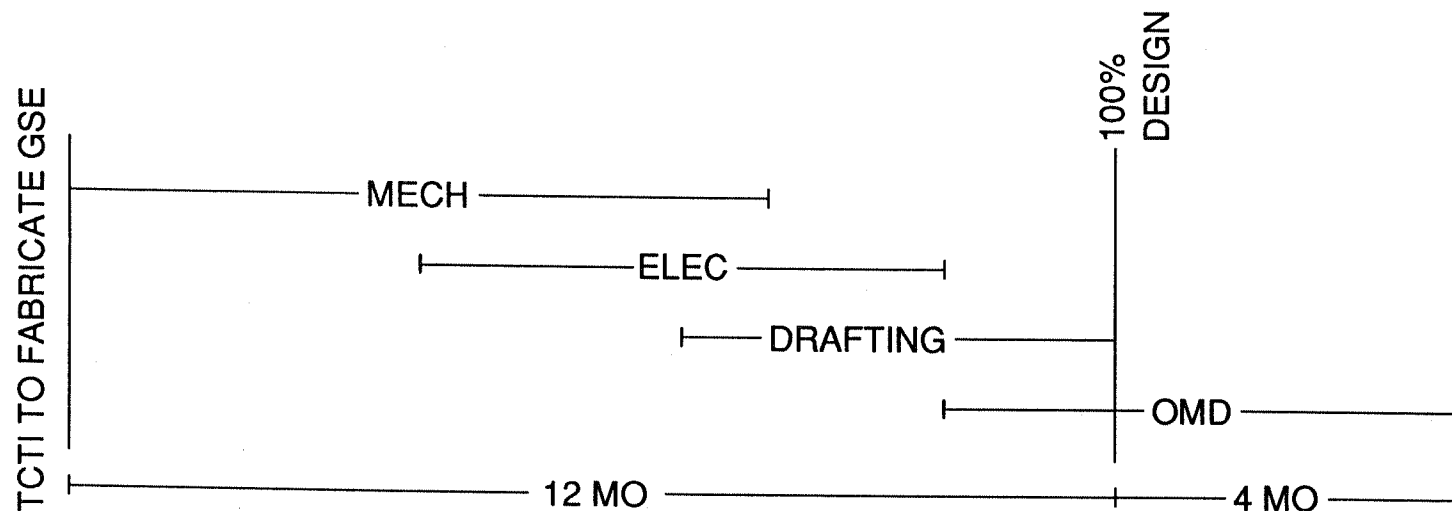
IT MAY BE FEASIBLE TO KEEP THE S70-0508'S AT THE LANDING SITES

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## LANDING SITES

### DESIGN

MECHANICAL	8 MO	1,280 MH
ELECTRICAL	6 MO	1,000 MH
DRAFTING	5 MO	800 MH
OMD	6 MO	500 MH



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## LANDING SITES

### COSTS

DESIGN	3,580 MH x \$33/MH	= \$ 118,140
EQUIPMENT	\$1.1 MILLION/TRL	= \$3,300,000
FPC-INSTL	\$200,000/TRL	= \$ 600,000
CHECKOUT	480 MH/TRL x \$33/MH	= \$ 47,520
SPARE LRU	\$400,000	= \$ 400,000
TOTAL		= \$4,465,660

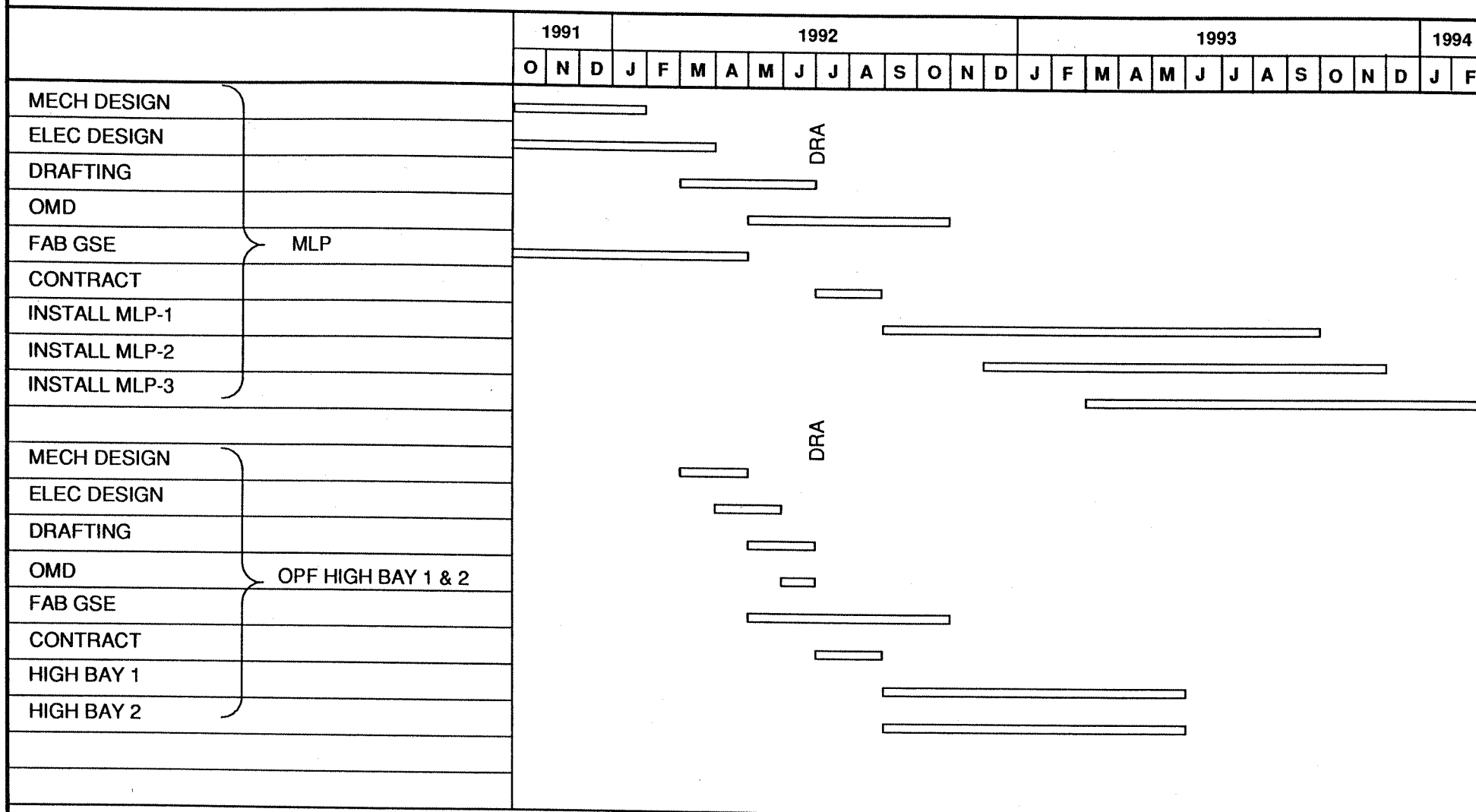
### INSTALLATION

6 MONTHS AFTER COMPLETION OF DESIGN

THESE ROM COST ESTIMATES ARE PROVIDED FOR PLANNING/INFORMATION PURPOSES ONLY, AND DO NOT CONSTITUTE COST AND PRICING DATA AND ARE NOT INTENDED TO BE A BASIS FOR NEGOTIATING BETWEEN LSOC AND NASA. IT IS NOT AN OFFER TO PERFORM THE SUBJECT WORK, BUT REPRESENTS AN ESTIMATE BASED ON OUR CURRENT UNDERSTANDING OF THE TASK.

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## SHUTTLE PROCESSING CONTRACTOR



DECEMBER 1990

# REFERENCE DATA

## METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

### NEW GROUND COOLANT SYSTEM FEATURES

- HANDLES A WIDE RANGE OF HEAT LOADS
- BUILT-IN REDUNDANCY TO SUPPORT LAUNCH ACTIVITY
- REFRIGERATION SYSTEM IS BASED ON CONSTANTS WHICH PROVIDES A SIMPLE SYSTEM THAT IS EASY TO CALIBRATE AND TROUBLE SHOOT
- SYSTEM USES PROVEN KSC COMPONENTS
- SYSTEM IS DESIGNED PER KSC STANDARDS
- SYSTEM HAS OPEN PALLETIZED CABINETS PROVIDING EASY ACCESS FOR MAINTENANCE
- TRANSDUCERS HAVE BUILT-IN CALIBRATION PORTS SHORTENING SYSTEM DOWNTIME
- INLET PIPING TO UNITS ARE PROVIDED FROM OVERHEAD, ELIMINATING TRIPPING HAZARDS
- SYSTEM IS INSTALLED IN A CONTROLLED ENVIRONMENT, REDUCING DETERIORATION, AND ADEQUATE SPACE AROUND GSE IS PROVIDED TO ENHANCE SERVICING AND OPERATION
- SYSTEM HAS REMOTE FILL PORTS AND OVERHEAD MONORAILS TO AID IN SERVICING

DECEMBER 1990

 **Lockheed**  
Space Operations Company

★ U.S.GPO:1989-0-633-627



# REFERENCE DATA

## METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

### NEW GROUND COOLANT SYSTEM FEATURES (CONT.)

- REFRIGERATION SYSTEM USES WATER-COOLED CONDENSERS, ELIMINATING ENVIRONMENTAL FLUCTUATIONS AND MECHANISM FAILURES ASSOCIATED WITH AIR-COOLED CONDENSERS
- ALL VALVES AND CONTROLS ARE AT A SINGLE LOCATION ON EACH UNIT
- SYSTEM IS OF MODULAR CONSTRUCTION; COMPONENTS CAN BE REPLACED WITH MINIMAL DOWNTIME
- ALL FITTINGS ARE KC OR WELDED, ELIMINATING LEAKS
- THERE ARE NO ORIGINAL EQUIPMENT MANUFACTURE COMPONENTS IN THE UNITS, SAVING LOGISTICS COSTS
- REFRIGERATION UNITS HAVE NO COMPLEX LOAD CONTROL SUBSYSTEMS

DECEMBER 1990

# REFERENCE DATA

## METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

### NEW GROUND COOLANT SYSTEM FEATURES (CONT.)

- REFRIGERATION SYSTEM IS INSTALLED IN SERIES PROVIDING REDUNDANT OPERATION WHICH PREVENTS ORBITER SUPPLY TEMPERATURE FLUCTUATION AND OPERATION INTERVENTION DURING A POSSIBLE REFRIGERATION UNIT FAILURE. THIS FEATURE WILL SIMPLIFY LAUNCH COMMIT CRITERIA
- SYSTEM USES LIGHTER, MORE RELIABLE 4-TON COMPRESSORS INSTEAD OF 20-TON COMPRESSORS THAT EXIST IN THE PRESENT SYSTEM
- SYSTEM HAS COMPLETE SUPPORT DOCUMENTATION WHICH ALLOWS UNITS TO BE MODIFIED FOR UNKNOWN FUTURE REQUIREMENTS AND ENHANCES OPERATIONS OF THE GSE
- SYSTEM IS CONSIDERABLY LESS EXPENSIVE IN FABRICATION THAN THE PRESENT GSE
- SYSTEM HAS AUTOMATIC PUMP DOWN CAPABILITY

DECEMBER 1990

# REFERENCE DATA

## METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

### CONTROLS

- STATE OF THE ART
- SYSTEM IS PICTORIAL, PROVIDING INSTANT RECOGNITION OF PERFORMANCE
- CONTROLS ARE MODULAR, ELIMINATING DOWNTIME
- TROUBLE SCREENS INSTANTLY IDENTIFY PROBLEMS (SOURCES AND LOCATIONS) AND PROVIDE DIRECTIONS ON HOW TO CORRECT THEM
- REAL-TIME PERFORMANCE CALCULATIONS CAN BE PERFORMED AND CONTINUOUSLY DISPLAYED
- SYSTEM HAS DATA RECALL CAPABILITY PROVIDING A SIGNATURE OF THE MACHINE'S PERFORMANCE, HISTORY, AND RELIABILITY
- CONTROLS ARE EXPANDABLE
- CONTROLS ARE COMPACT
- MONITOR IS NEMA IV CONSTRUCTION
- SYSTEM HAS LPS REDUNDANCY
- CONTROL FUNCTIONS ARE MORE ACCURATE THAN THE EXISTING EQUIPMENT

DECEMBER 1990

# REFERENCE DATA

## METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

### CONTROLS (CONT.)

- THE CONTROLS DO NOT TAKE AWAY EXISTING CAPABILITY; RATHER, THEY ENHANCE IT
- SYSTEM HAS FULL MANUAL CAPABILITY AND FULL AUTOMATIC CAPABILITY
- SIMPLE OPERATION - AS EASY AS A REFRIGERATOR
- SYSTEM HAS PASSWORD-LEVEL ENTRY PREVENTING INEXPERIENCED PERSONNEL FROM MANGLING THE EQUIPMENT
- CAPABILITY EXISTS TO MONITOR SYSTEM REMOTELY AND INEXPENSIVELY BY TELEPHONE LINE
- UNITS HAVE INDEPENDENT CONTROLS FOR REDUNDANCY
- PROGRAMS ARE STORED IN NON-VOLATILE MEMORY AND WILL BE CONTROLLED BY TDC RELEASE
- SYSTEM OPERATION WILL BE BY PICTURE AND BUTTON AND WILL NOT REQUIRE COMPUTER KNOWLEDGE
- ABNORMAL CONDITIONS WILL BE CLEARLY DISPLAYED AND DOCUMENTED
- SYSTEM HISTORY CAN BE STORED AND RECALLED ON THE DISPLAY TO AID DIAGNOSTICS

DECEMBER 1990

---

# **MANAGEMENT BRIEFING ADDENDUM**

## **METHOD OF DESIGN FOR GROUND COOLANT SYSTEM TO PAD A AND PAD B**

DECEMBER 1990

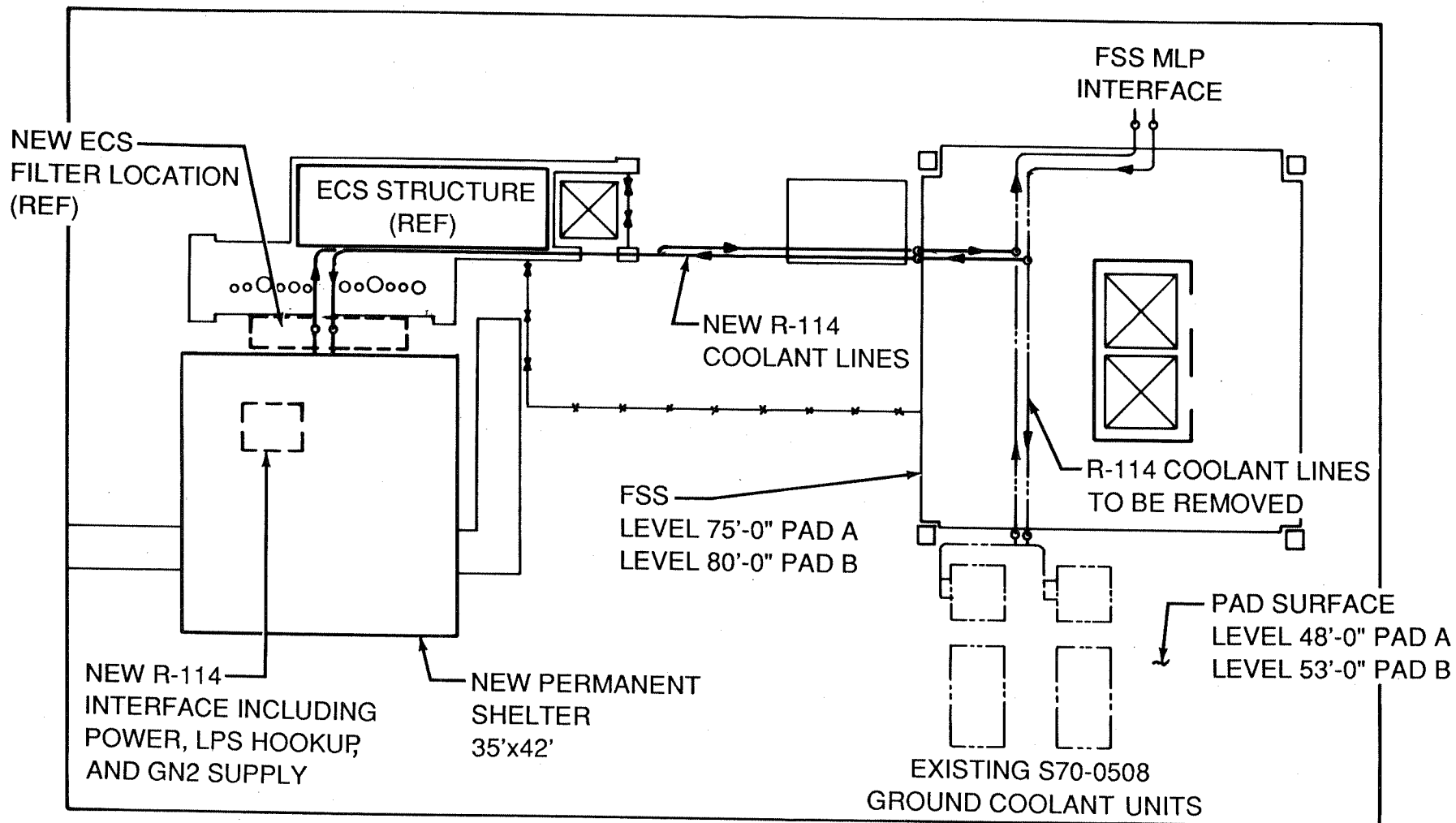
KSC FORM 29-43 (REV. 4/86)

 **Lockheed**  
*Space Operations Company*

★U.S.GPO:1989-0-633-627

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## PLAN - PAD SURFACE



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## PAD A AND B

- EQUIPMENT
  - DESIGN EXISTS
  - REQUIRES TCTI TO START FABRICATION
- MECHANICAL INSTALLATION DESIGN
  - MODIFY FLUID DISTRIBUTION SYSTEM
- ELECTRICAL INSTALLATION DESIGN
  - USE EXISTING HIM SPACE
  - PROVIDE HARDWIRE SAFING PANEL IN FIRING ROOMS (TBD)
  - ADD NEW CABLING TO GSE
- BUILDING
  - DESIGNED AND CONSTRUCTED USING C of F FUNDING

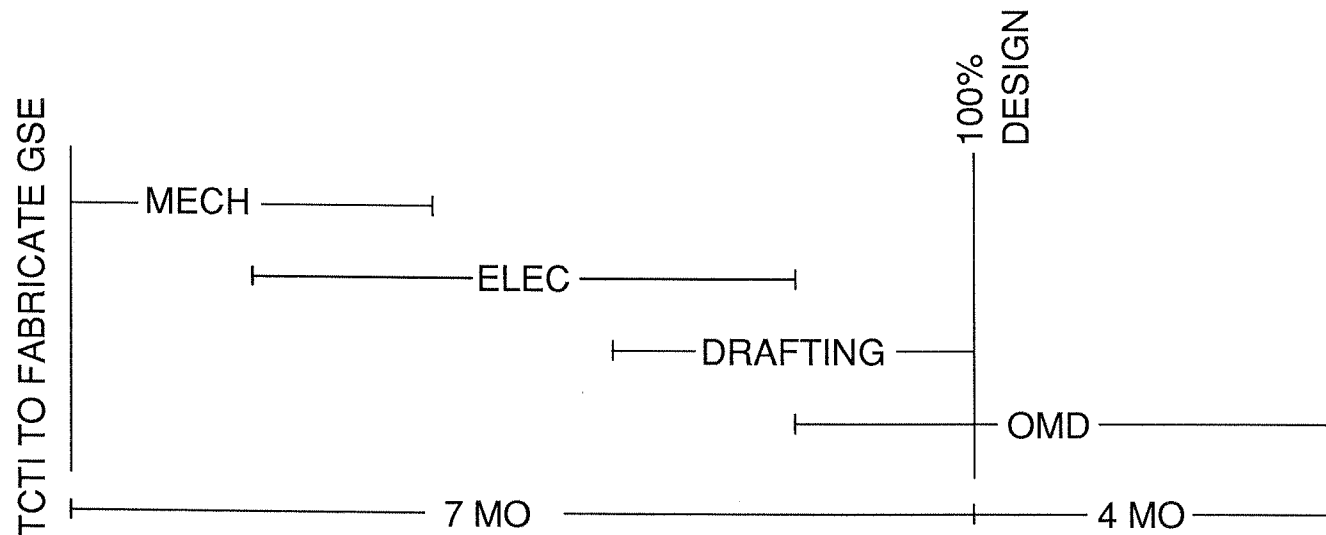
DECEMBER 1990

# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

## PAD A AND B

### INSTALLATION DESIGN

MECHANICAL	3 MO	480 MH
ELECTRICAL	4 MO	600 MH
DRAFTING	4 MO	640 MH
OMD	6 MO	500 MH





# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## PAD A AND B

### COSTS

DESIGN	2,220 MH x \$33/MH	= \$ 73,260
EQUIPMENT	\$1.1 MILLION/PAD	= \$2,200,000
FPC-INSTL	\$250,000/PAD	= \$ 500,000
CHECKOUT	480 MH/PAD x \$33/MH	= \$ 31,680
SPARE LRU (509/510's)	\$400,000	= \$ 400,000
ELECTRICAL MISC	\$100,000/PAD	= \$ 200,000
TOTAL		= \$3,404,940

### INSTALLATION

9 MONTHS AFTER BUILDINGS  
ARE COMPLETE. GSE TO START  
FABRICATION AT START OF  
INSTALLATION DESIGN.

THESE ROM COST ESTIMATES ARE PROVIDED FOR PLANNING/INFORMATION PURPOSES ONLY, AND DO NOT CONSTITUTE COST AND PRICING DATA AND ARE NOT INTENDED TO BE A BASIS FOR NEGOTIATING BETWEEN LSOC AND NASA. IT IS NOT AN OFFER TO PERFORM THE SUBJECT WORK, BUT REPRESENTS AN ESTIMATE BASED ON OUR CURRENT UNDERSTANDING OF THE TASK.



# METHOD OF DESIGN FOR GROUND COOLANT SYSTEM

---

## BUILDING

### DESIGN

STRUCTURAL	400 MH x \$33/MH	= \$ 13,200
MECHANICAL	200 MH x \$33/MH	= \$ 66,000
ELECTRICAL	200 MH x \$33/MH	= \$ 66,000
TOTAL		= \$ 145,200/PAD

### FPC

STRUCTURAL	= \$ 147,000
MECHANICAL	= \$ 20,000
ELECTRICAL	= \$ 20,000
	<hr/>
TOTAL	= \$ 187,000/PAD
TOTAL/PAD	= \$ 332,200
TOTAL PAD A AND PAD B	= \$ 664,400

THESE ROM COST ESTIMATES ARE PROVIDED FOR PLANNING/INFORMATION PURPOSES ONLY, AND DO NOT CONSTITUTE COST AND PRICING DATA AND ARE NOT INTENDED TO BE A BASIS FOR NEGOTIATING BETWEEN LSOC AND NASA. IT IS NOT AN OFFER TO PERFORM THE SUBJECT WORK, BUT REPRESENTS AN ESTIMATE BASED ON OUR CURRENT UNDERSTANDING OF THE TASK.